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ABSTRACT

Research evidence indicates that one important variable in learning or development is the degree of match between relevant learner and environment characteristics. It has been argued that, to provide learning environments that would match student characteristics, teachers should be able to understand and identify the relevant characteristics of students and of the learning environment and then learn to provide an environment to match student characteristics in ways that would promote desired behavior. There is a need to understand the nature of the differences between what children or adolescents will respond to in the environment. Such understanding has been enhanced by recent research and theory in developmental psychology. A good description has been provided of the nature of important changes that occur during the school years and how these changes relate to some salient characteristics of children's and adolescents' perceptions of and responses to various aspects of their environment. A synthesis is presented of research findings on developmental stages (late pre-operational thought, early concrete operations, late concrete operations, early formal operations, late formal operations) and teacher effectiveness. Implications for the content of teacher education programs are discussed. (JD)

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A Developmental Analysis of Research on Effective Teacher-Student Interactions: Implications For Teacher Preparation

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In 1961, Harvey, Hunt, & Schroder suggested that teachers, parents, and others who function in educational roles with children share at least one common characteristic: they provide an interpersonal environment for the child with whom they interact. Learning takes place within this interpersonal environment. They also suggested that characteristics of that environment could be expected to affect the development of the child. Since that time, research evidence has been accumulating that one important variable in learning or development is the degree of match between relevant characteristics of the learner and those of the environment (Hunt, 1966a; Hunt & Sullivan, 1974; Miller, 1978; 1981).

Hunt (1966b) has taken this argument further to propose that such results have implications for the training of those who provide training environments, e.g., teachers. Using the Lewinian notion that behavior is a function of the interaction between the individual and the environment, he argued that, in order to provide learning environments which would match student characteristics, the teacher would have to understand and be able to identify the relevant characteristics of children and of the environment and then learn to provide an environment matched to student characteristics in ways that would promote desired behavior (Hunt, 1966b; Hunt & Sullivan, 1974).

This is a fairly simple and straightforward argument, and, although presented in an oversimplified form which needs qualification in specific application, it is used both as an overall framework for organizing this review of research on teacher-student interactions as they affect teaching effectiveness and as a basis for developing the implications of this research for teacher education.

A major reason for taking this approach is not inherent in the approach itself, but is inherent in the nature of developmental psychology as a discipline. Developmental psychology is the study of changes that occur across the life span. To say that children change is a truism. Teachers know that kindergarten students are different from second graders, are different from

fifth graders, are different from eighth graders, are different from high school sophomores, are different from high school seniors. Teachers also know that children need to be treated differently from adolescents; that they need to have a different learning environment.

If we take seriously the research on matching and the idea that the differences in children and adolescents will determine the nature of the characteristics of the environment which will result in optimum learning and/or development, then we need to understand the nature of the differences between various ages/stages in development and how they may affect what children or adolescents will respond to in the environment. Such understanding has been enhanced by recent research and theory in developmental psychology which has provided a reasonably good description of the nature of important changes which occur during the school years and how these changes relate to some salient characteristics of children's and adolescents' perceptions of and response to various aspects of their environment.

Although both the nature of developmental change and the characteristics of effective teachers have been active areas of research over the past decade, they have rarely informed each other in ways suggested by the above argument. In what follows, a synthesis of these two areas is attempted. Such a synthesis will provide a basis for understanding why given teacher characteristics or behaviors are effective at one grade level and not at another. This understanding can then be used to analyze and inform the content of teacher preparation programs.

Developmental Changes During the School Years

An important basis for understanding the nature of the developmental changes across the school years has been provided by the work of Piaget and his colleagues in the area of the developmental characteristics of thinking (e.g., Inhelder & Piaget, 1955/1958; Inhelder & Piaget, 1964/1969). Other investigators have found parallel stages in areas of social development including a) relations with adults and peers (Youniss, 1980), b) understanding of the perspectives of others (Feffer, 1959; Feffer & Gourevitch, 1960; Flavell, 1977; Flavell, Botkin, Fry, Wright, & Jarvis, 1968; Selman & Jaquette, 1977), c) moral reasoning (Kohlberg, 1969), d) understanding of social conventions (Furth, 1980; Turiel, 1977), e) religion (Elkind, 1961, 1962a, 1963; Elkind & Elkind, 1962; Fowler, 1981), and f) personality development including the development of a sense of personal identity (Erikson, 1959/1980, 1963, 1968) and the concept of self (Broughton, 1978; Elkind, 1981).

The discussion of development which follows attempts to integrate these sources to develop as comprehensive a picture as possible (in the limited space available) of the expectable cognitive and social characteristics of children and adolescents as they change across the school years.

It is possible to understand many of the characteristic behaviors of children of different ages by making the assumption that children use an un-

derlying mode of thought which undergoes developmental change to understand the world around them. The descriptions of developmental changes in cognitive, personality and social development over the school years appear to be consistent with the notion that the underlying mode of thought changes from a mode that is based on the image in preschool and elementary school to one based on concepts represented by language in junior high and high school.

The image was discussed by Piaget (1945/1951) as developing out of the sensorimotor thought of infancy and being intermediate between that type of thinking and the conceptual thought of the adult. The image is probably best understood as being something like a photograph. While children's images undoubtedly include elements other than visual (e.g., auditory, tactile, kinesthetic), they appear to share with the photograph the characteristic of being a *direct* representation of children's experience of particular situations/people/events. That is, they are "pictures" in children's minds, and have the status of being a direct representation of the actual and specific situation as experienced by the child.

Unlike images, signs (including language) are not direct representations of actual situations. Instead, they have an arbitrary relationship to what they represent in the sense that the pattern of sounds utilized to represent a concept does not inhere in the concept in the way that the structure or pattern of colors in a photograph inheres in a particular picture. For example, the sound pattern used to designate one's female parent could as easily be "angmar" as "mother." This arbitrariness of language eventually allows thought to break away from the "concrete" image to become "abstract."

There are two major changes in the underlying mode of thought across the school years. In the preschool period the image is the primary mode of thought. Furthermore, thought uses images that are constructed in the context of *immediately present experience*. During this period, language is involved in thinking only as it is or has been incorporated into children's experiential images.

Sometime between the ages of five and seven a change begins to occur and, while the image remains the underlying mode of thought, *language becomes able to construct images in the absence of immediately present experience*. Development of the ability to construct images from language is consolidated during the elementary school years. This consolidation generally consists of children abstracting, more and more precisely, the meaning of the concepts of the language. They do this by figuring out how concepts relate to other concepts in describing images. For example, preschool children use the term grandfather in the presence of a specific person or of people who have similar physical characteristics, whether or not they are actually grandfathers. On the other hand, nine or ten-year-olds understand that their grandfather is the father of their father or mother and that everyone has grandfathers. They understand that not all older men are grandfathers. They can, therefore, use the word grandfather to create an image of a specific person, for example in

a story, and one of the aspects of that image is that the character is the father of one of the parents of the children in the story.

Once this consolidation is stable it leads to the recognition that more than one set of concepts could be used in a given situation and that the different sets would give rise to different images. For example, there are other conceptual systems than those of family relations which could be used to describe the storybook grandfather. He might be president of a corporation, a doctor, or a policeman. The search to reconcile the various ways of classifying leads to the second major change in mode of thought, the development of abstract thinking in adolescence.

Because each development undergoes a period of transition and then a period of consolidation, the school years from kindergarten through twelfth grade encompass five identifiable periods. For convenience and ease of identification, the Piagetian labels for these periods will be used in this paper. Late Preoperational Thought defines the period in which the image is still primary; it is characteristic of preschool children. Early and Late Concrete Operational Thought will be used for the period in which the image is becoming organized by the concepts of the language, and Early and Late Formal Operational Thought for the period in which thought is freed from the specific image.

It is important to include a discussion of all of these stages because, while stages can be identified by age/grade level for many children, development is never as clear-cut in real life as it appears in this sort of description. Growth is very much a product of experience. In areas where children have had considerable experience of the right nature, they may exhibit behavior which is characteristic of children older than their own age. In areas where experience is limited, development might lag behind that of children of comparable age (Uzgiris & Hunt, 1975). This means that a given child might exhibit behavior that is characteristic of more than one "stage" at any given age. It also means that not all children of the same age will be at the same "stage" in any given area of experience.

The majority of children in the elementary school years fall into the stages of early and late concrete operations with the transition between them occurring somewhere between third and fourth grade. A significant number of kindergarten children use late preoperational reasoning and some first and even second grade children may be preoperational in some areas of thinking. On the other end of the elementary school age spectrum, as many as ten percent of sixth-grade children have started the transition into adolescence and exhibit characteristics of early formal operations. Increasing numbers of students become early formal operational during the junior high school years. By the junior year of high school, the characteristics of late formal operational thought appear in some students.

While it appears that almost everyone but severely mentally retarded individuals becomes concrete operational, this is not the case with formal operational thinking. Various studies show that a significant proportion of adults do not show the characteristics of formal operations in some areas of

development. The percentages vary with the population studied, the area of development being investigated, and the stringency of the criteria used, and range from 20% to 70% of the study sample showing formal operations (c.f., Kuhn, Langer, Kohlberg, & Haan, 1977; Neimark, 1975; Rowe & Marcia, 1980). Amount of education is clearly associated with the development of formal operational reasoning, although it is not so clear in which direction the causal relationship lies (Neimark, 1975). It is, however, apparent that a number of adults are not yet at the level of late formal operational thought. The significance of this for teacher-student interaction will be discussed later in the paper.

Developmental Characteristics and Effective Teaching

The nature of the changes discussed above may be expected to have dramatic effects on the nature of the teacher-student interactions which will promote effective teaching. The research on effective teacher-student interactions rarely directly addresses the question of the developmental changes or of the match between environmental characteristics and those of the child, although the research on Aptitude-Treatment-Interaction (ATI) provides some evidence in this regard (Miller, 1981). For the most part, the research examines teacher behavior as input and student learning or attitude as outcome without regard for the effect of any matching that might occur. While some authors (e.g., Brophy, 1983) recognize that there are differences in students in different grades (he calls these context variables) which will call for different teaching practices, such differences have generally not been systematically studied in this literature.

For the purposes of synthesizing the developmental psychology and teacher effectiveness literature, research and theory from developmental psychology has been summarized from the perspective of the hypothesized underlying modes of thought for each of the five stages which are found in school-age children and adolescents. The research on characteristics of effective teaching was summarized by grade level, selecting for analysis those characteristics which have either appeared at one grade level and not at others or which differed from one grade level to another. Then an attempt was made to relate what works or does not work at each level to the characteristics of children of that level which had been derived from the developmental analysis. From this analysis some fairly consistent patterns emerged which can be related to developmental characteristics of students. Where possible, these patterns have been grouped into two general and somewhat arbitrary clusters: a) teacher-student instructional interactions, and b) characteristics of teacher control/management strategies. Some research on effective teaching in adolescent populations has been reviewed which specifically examines the match between developmental and environmental characteristics as a variable.

Late Preoperational Thought (Preschool and Kindergarten)

Thinking at this stage is dominated by the internal image of immediately present experience. Present images are related to past images through perceptual similarities, but the two seem to merge into one image (Piaget, 1945/1951). At this stage children have good command of the adult language of the home, but that language is simply a part of the image for them rather than separate from it. Consequently, language can be used to describe an image or to direct attention to salient features of an image. Piaget (Inhelder & Piaget, 1964/1969) speaks of children of this age as being perception bound. He also describes the thought of the preoperational child as analogous to a series of "still" images much like the individual frames of a movie film (Piaget, 1945/1951).

Progression to the next stage is presumed to result from increased facility in describing images by language. This increase is apparently due to increases in descriptive vocabulary, accuracy in understanding the meaning of words, and in grammatical complexity. These increases are presumed to occur as children attempt to communicate about their images.

The primacy of the image of immediate experience of this stage is consistent with research results in various areas of preschool behavior. Because preoperational children are tied to what is immediately in front of them, they have difficulty coordinating information from one image to another. This results in their failure to be able to perform on the Piagetian conservation tasks. They are unable to coordinate information from one part of the problem (one image) with that from another (a second image) because their image changes with the shift in attention (Piaget, 1941/1965). Similarly, preoperational children have difficulty seriating or classifying objects consistently. In these tasks they tend to either form perceptual wholes (e.g., build houses or trains) or to shift the basis they are using to classify or seriate from one object to the next. Olver and Hornsby (1966) labeled this phenomenon "edge-matching." The coordination of past with present in the image leads to the distorted time sense of children of this age (Elkind, 1981).

Because images are direct representations of reality, they can only be described literally. Metaphoric language is interpreted literally (Gardner, Kircher, Winner & Perkins, 1975). The image is a "positive" representation of experience. It represents experience, not its "negative." For this reason, preoperational children have a difficult time inhibiting actions when the direction is "Don't do . . . " (Luria, 1961). Another characteristic of preoperational children which is consistent with the view that they are bound to images of immediate experience is their inability to distinguish appropriate from inappropriate behavior, and winning at games from losing at them. Kohlberg (1969) has shown that the criteria used by children of this age for evaluating behavior in moral dilemma situations are based on which acts are punished and which are not. Piaget (1932/1962) showed that children of this age did

not use consistent criteria for deciding whether someone had won a game, nor were they able to coordinate the specific actions which go into a game into a regular sequence.

Perhaps the flavor of preoperational thinking is best captured by an example. These abound in A. A. Milne's *Winnie-the-Pooh*:

> Once upon a time, a very long time ago now, about last Friday, Winnie-the-Pooh lived in a forest all by himself under the name of Sanders.
>
> ("What does 'under the name' mean?" asked Christopher Robin.
>
> "It means he had the name over the door in gold letters and lived under it . . .") (Milne, 1926, p. 3).

In this passage are examples of the assimilation of everything that happened previously to being long past and of the nature of the preoperational image of what it means to "live under the name of . . . "

Viewing the thought of preoperational children in this way allows the derivation of some implications for educational environments. Preoperational children may be expected to have difficulty in meeting some classroom expectations that older children understand more readily. Preoperational children may be expected to have problems when expectations require images which are not readily available, for example, a) when the environment is unfamiliar, b) when instructions are to carry out actions which are new, c) when the instructions describe actions in an abstract rather than literal way (e.g., "Clean up the room," as opposed to "Put your pencils in your desk."), d) when there is more than one instruction in a string, or e) when the instruction is to not do something. Children need to be shown specifically what to do and each demonstration should be accompanied by a verbal description with children then doing and describing for themselves. Demonstrations and carrying out of such instructions should be repeated in context until children can carry them out alone. Instructions should not be expected to generalize to new situations because images are situation specific. Demonstrations should be repeated as children need them.

The same sort of considerations apply to instruction of content. Central attention should be given to the coordination of descriptive language with the activity of the child. Instruction not tied to physical activity of children or to children's spontaneous questions may be expected to be less effective.

While there is relatively little research specifically on characteristics of effective teaching in kindergarten, some studies of both kindergarten and first and second grades have yielded results which are in line with these expectations. From the perspective of behavior management, a technique which has been found to be helpful to children through second grade in learning to control their own behavior is a modeling with verbalization procedures. At first, students watch the instructor model the desired behavior while describing the actions verbally. Then the students are helped to talk through the behavior as they do it themselves (Camp & Bash, 1981; Meichenbaum & Goodman, 1971). This technique has been used largely with children who are behavior problems in the classroom and it has been criticized because it does not appear to be reliably successful above the second- or third-grade

level (Brophy, 1983) and because the behavior learned fails to generalize beyond the specific situation in which it is utilized (Pressley, 1979).

From a developmental perspective, this technique can be seen as reliably associating language with image, a skill which is supposed to be occurring during the late preoperational period and which will lead to progression to the next stage. Thus, it makes developmental sense to use this sort of teaching technique at this stage. To the extent that children who are behavior problems in first and second grades lag developmentally behind their peers, this technique should prove helpful. Its failure to generalize is to be expected developmentally. The image of preoperational children is so situation specific that children may not see the similarity unless it is verbally called to their attention. It should not be expected to work as well at later stages because older children may be expected to misbehave for reasons other than lack of behavioral understanding of verbal commands or the lack of an "appropriate image" for the situation.

Amount of teacher talk is negatively correlated with reading achievement for low socioeconomic status (LSES) first- and second-grade students (Soar, 1973). Deutsch (1973) reports that LSES children are apt to have a lower mean level of cognitive development than middle class children. Preoperational children need to be actively relating words to experience/images. Teacher talk, unless carefully and consistently related to children's activity, may be expected to confuse more than teach in the preoperational period. Once children are concrete operational, however, this should be less true because words assist in constructing images in the later period.

From the perspective being developed here, later learning will depend, at least in part, on the coordination of image and language laid down in the late preoperational stage. As children become better and better able to use language to describe the images of thought, they become better and better able to use language to create reliable images in the absence of the real situation. A major reason for the provision of a kindergarten experience at the end of this stage is to help children learn the image base for many of the concepts and appropriate student behaviors which they will need in later schooling. Children's learning such words as larger, older, right, left, three, etc., as they describe their perceptions of immediate situations is facilitated by their being provided with a situation and having their actions in that context talked about in the same terms over and over again. This facilitates the consolidation of the connection between image and related language.

Once children are able to evoke the same image reliably through the use of the same words, they gradually become able to create images in their minds and to compare these images with one another. It is this ability to create and compare images which is presumed to underly movement to the next stage (Piaget & Inhelder, 1966/1969).

Early Concrete Operations (Grades 1 to 3)

In all of the concrete operational period it appears that the image is still the underlying mode of thinking. The difference between concrete opera-

tions and preoperations is the *ability to use adult language to accurately construct images in the absence of immediately present experience.* This ability appears to allow children to hold more than one image in mind at one time, which, in turn, allows comparison of images of past and present, enabling children to begin to understand what remains constant and what changes as one image is transformed into another. This allows the formation of true concepts, that is, ideas which represent the common or constant aspects of objects as opposed to their particular manifestation in a given image. In early concrete operations, children begin to abstract the meanings of concepts out of their images. This is a gradual process which becomes increasingly consolidated over the period.

A body of developmental research is available which is consistent with this view of the nature of thought in concrete operations and which also sheds further light on its nature. Piaget's work on conservation, classification and seriation (cf., Piaget, 1941/1965; Inhelder & Piaget, 1964/1969) shows that children at this stage can coordinate information in ways which allow them to build systems of concepts and relationships. Early concrete operational children appear to be limited, however, in that they can only use one "constant" or relationship at a time.

Weir (1964) reports, for example, that children of this age are poor problem solvers, tending to perseverate on an initial point of view even when it appears to be contradicted by evidence (from the adult perspective). Their verbalizations indicate that they find a way to reconcile the evidence with their point of view rather than *vice versa.* Peel (1960) reports similar data.

The research on role-taking is also consistent with the conception of early concrete operational thinking as being limited to a single concept or relation at a time. Children of this stage use their own conception of what to do in a situation and do not coordinate it with the view of others of the same situation (Flavell et al., 1968; Selman & Jaquette, 1977). When asked to retell stories from the perspective of different characters, children simply retell the same story (Feffer, 1959; Feffer & Gourevitch, 1960).

The focus on a simple basis for understanding an event helps to explain why children do not coordinate their understanding that they have to pay for goods with an understanding that shopkeepers also have to pay for the goods they sell. It is as if, in one event, they buy and the shopkeeper sells; but the shopkeeper does not buy (Furth, 1980). Children of this stage view social conventions as simple descriptions of regularities in social behavior (Turiel, 1977).

The ability to abstract information to form true concepts enables children to begin to have an understanding of what it means to win at games (e.g., have more marbles than the other), but they still do not have a conception of all of the rules and how they fit together to regulate the game. They consistently "modify" the rules (to their advantage) and they eliminate from the game any rules that are in dispute (Piaget, 1932/1962). Consistent with this, their criteria for evaluation of behavior as good or bad center around a

"naive hedonism" in which that behavior is good which serves to meet one's needs (Kohlberg, 1969).

Implications of this view of early concrete operations for educational environments can be derived for both management of instructional processes and classroom behavior. Instructionally, it would appear that lessons should be focused on a single concept or operation, should involve direct instruction, and then give the children the opportunity to practice using the concept or relation in a variety of contexts. Because the children's own images are being used to abstract the concepts, such images should be evoked through involving children in active response or through active interaction with illustrative materials. This latter should be particularly important where the children's background has not provided immediate experience from which the concepts being taught can be readily abstracted.

Characteristics of effective teaching at this level are supportive of these expectations. The most effective instructional interactions in these grades are strongly teacher directed. Teacher initiated interactions characterized by low-level (on Bloom's taxonomy) or product questions are positively correlated with achievement; inquiry or inferential, high-level questions are negatively correlated with achievement in these grades (Brophy & Evertson, 1974, 1976; Coker, Lorentz, & Coker, 1976; Soar, 1973; Stallings & Kaskowitz, 1974). The effective teacher calls on each student in a systematic way to respond or practice a skill, and does not rely on volunteers (Brophy & Evertson, 1974). Whether students are working in large groups or individually, it is important that the teacher monitor work closely (Anderson, Evertson, & Emmer, 1980; Berliner & Tikunoff, 1976; Brophy & Evertson, 1976; McDonald & Elias, 1976; Soar, 1973). Reading scores increase when teachers respond with paraphrases or rephrases of student comments (Good, Biddle, & Brophy, 1975; Martin, Veldman, & Anderson, 1980), and classroom work related to student interests and background is more effective (Emmer, Evertson, & Anderson, 1980).

All of these techniques are consistent with early concrete operational children's need to learn to organize their images using adult concepts. Low-level questions with immediate correction through rephrasing and practice are essential to consolidation of these concepts. Because there are many potential concepts which could be used, children need teacher direction to focus on what is important. Inquiry and discovery techniques can allow students the freedom to focus on relationships which are not important in organizing conceptual systems for academic work.

Children are presumed to be constructing the concepts important to schooling during this stage. Consequently, they should not be expected to be able to know when their work is correct. This is consistent with research indicating that children of this age view effort, rather than ability or knowledge, as the important element in success (Frieze & Snyder, 1980; Nicholls, 1978).

In the management of social behavior in the classroom, it is important to remember that, although children can construct an image of the goals of

activity and means of attaining those goals, they have no conception of the appropriateness of those means. Clear standards of what is appropriate and inappropriate need to be established and consistently maintained. Children need to be shown how to do the appropriate things, over and over again, in order to abstract out the constancy in various situations from the image.

Consistent with this, it appears that students at this age level are best served by teachers who teach students how to behave through direct instruction and sequential practice in appropriate behaviors such as getting materials, putting them away, getting a drink and cooperating with classmates (Anderson et al, 1980). Effective teachers do not ignore inappropriate behavior; they act quickly to stop disruptive behavior through additional instruction in appropriate behavior rather than prohibition and punishment (Anderson et al., 1980; Coker et al., 1976; Emmer et al., 1980).

Late Concrete Operations (Grades 4-6)

According to the perspective on thinking being developed in this paper, in late concrete operations, the underlying mode of thinking is still the image constructed by language. The primary difference between early and late concrete operations appears to be that children in the latter stage begin to coordinate the relations constructed in early concrete operation with each other. For example, Piaget reports that late concrete operational children can form multiple classifications and seriations and they have a clearly differentiated conception of the concepts of "some" and "all" (Inhelder & Piaget, 1964/1969). They begin to coordinate temporal sequences between events into cause-effect relationships (Inhelder & Piaget, 1955/1958).

A new skill also appears. Children begin to be able to understand content outside their own experience by applying the concepts abstracted from that experience to the new content (Inhelder & Piaget, 1955/1958; Inhelder & Piaget, 1964/1969). This looks like hypothetical thinking in the sense that children are making predictions about unknowns, however, they still use primarily descriptive concepts and are unable to coordinate these concepts in a logical way.

For example, late concrete operational children are able to describe what happens to the trajectory of a billiard ball as the angle of the cue is changed, and this allows them to make predictions about new trajectories based on past experience. They do not, however, examine the logical relationship of reciprocal implication as a way of understanding possible relationships between angle of incidence and angle of reflection, and so do not arrive at the law of equality (Inhelder & Piaget, 1955/1958).

In social interactions, late concrete operational children begin to coordinate their own perspective of what is important in a situation with the consequences of the fact that they assume that the other person in the interaction will share their perspective on what is important. They then adjust their behavior based on that assumption (Flavell et al., 1968; Selman & Jaquette, 1977). They understand that different characters in a story may per-

ceive the same event from a different point of view, and adjust their telling of the story accordingly (Feffer & Gourevitch, 1960).

Children at this stage have complete and detailed knowledge of rules of games and how they interrelate to regulate interindividual perspectives in games (Piaget, 1932/1962). They understand that shopkeepers buy what they sell to customers (Furth, 1980) and that social conventions are arbitrary (Turiel, 1977). Consistent with these orientations are the criteria which children of this stage use to determine good and bad. Actions are good if they are consistent with what is approved by others, the so-called "good boy" orientation (Kohlberg, 1969).

Students with these capabilities may be expected to present a somewhat different problem for instructional and behavioral management than that posed by children of earlier stages. Assuming that they have good knowledge of important concepts, children of this stage should benefit from instruction in which relevant conceptual systems are juxtaposed and the implications of that juxtaposition explored. They should also benefit from the systematic use of existing concepts to understand new content, for example, the use of addition and subtraction in teaching multiplication and division. These activities need to be strongly teacher directed at the outset because children have no criteria to decide which are academically important concepts and which are unimportant.

These expectations are consistent with data that indicate that instructional interactions involving a moderate frequency of low-level questioning and increased frequency of pupil initiated interaction and discussion promote achievement in a variety of subject areas (Coker et al., 1976; Gall, 1977; Good & Grouws, 1977; Taebel & Coker, 1980). Because students lack internal criteria for knowing the correct conceptual system to use, it is important for teachers to help students understand what to do by being clear and avoiding ambiguity (Beck, 1967; Good & Grouws, 1977; Samuels & Griffore, 1980). When students have difficulty, process explanations are effective (Good & Grouws, 1977). Teacher clarity improves performance on higher level questions (Winne, 1977).

In the area of social behavior, children recognize the arbitrariness of standards for appropriate behavior and are oriented toward doing what is approved. This has the potential of leading to some seriously inappropriate behavior through the mechanism of peer influence because that which is peer approved is as valid as that which is adult approved. On the other hand, there is a repertoire of appropriate behavior built up from prior experience. There may be less need for direct instruction in appropriate behavior than earlier, however, consistent maintenance of standards and monitoring of potential trouble is necessary.

These characteristics imply that classroom management will be a somewhat different problem than earlier. Now, generally appropriate behaviors should not be viewed as routines to be taught, but as conduct to be expected. Insistence on attention to task and conformity appears to facilitate achievement as does acting quickly to stop disruptive behavior (Good & Grouws,

1977; Good et al., 1975). On the other hand, because students do not want to stand out, overt teacher praise is less effective in this age group than earlier (Brophy, Rohrkemper, Raschid, & Goldberger, 1983; Good & Grouws, 1977; Samuels & Griffore, 1980). Now children start to distinguish skill from effort as variables in success and more difficult tasks are more rewarding (Nicholls, 1978). Thus, effective teachers focus on task involvement (Good & Grouws, 1977), and do not distract students or raise anxiety levels by reminding students about their work or threatening them with time limits (Brophy, 1983).

Early Formal Operations (Grades 7-10)

Piaget observed that, somewhere around the age of twelve, the logical reasoning, which he labeled formal operations, begins. This reasoning is characterized as focusing on the possible ways of conceptualizing a situation rather than focusing on the description of images of reality, as in earlier stages (Inhelder & Piaget, 1955/1958). It is consistent with this change in orientation to suggest that the underlying mode of thinking has shifted from the image to the conceptual systems which have come to represent the image during concrete operations. This, in essence, is consistent with the conceptualization of the second signal system of Vygotsky (1934/1962).

As with earlier stages, data exists which is consistent with the notion that thought becomes freed from the image in this stage. Piaget's data suggest that early adolescents utilize alternative conceptual systems to analyze situations although they are not yet able to use logic to coordinate these conceptual systems into the set of all possible combinations. Consequently, they develop some hypotheses in a somewhat unsystematic fashion, test these against reality (i.e., experiment), and use the data and additional hypotheses suggested by the experiment to develop a system which is consistent with the data. This period, then, can be seen as a stage of moving back and forth between the image generated by the experiment and constructions generated by purely conceptual analysis.

Similar characteristics are observed in social areas. By the end of the late concrete operational period, children have moved from recognizing the arbitrary nature of the behavioral regularities which are supposed to govern interpersonal relations to a basic respect for general rules of interpersonal conduct (Turiel, 1977). Harvey, Hunt, and Schroder (1961) identify this behavior as Stage I in their system of personality development. Kohlberg (1969) found this orientation in his fourth stage, the "law and order" stage of the development of moral reasoning. This coordination of concrete behavioral regularities into one overarching system marks the consolidation of concrete operational thought.

In the early formal operational period, changes in these systems appear, all of which suggest a freeing of thought from the specific concrete action and a recognition that more than one rule system can apply to a given situation. Turiel (1977) reports that twelve- to thirteen-year-old adolescents begin to view the rules that they simply accepted earlier as being arbitrary. Harvey, Hunt, and Schroder (1961) find that individuals begin to recognize that rules

need to be modified to take individual circumstances into account. Kohlberg (1969) finds that individuals begin to move toward an orientation which regards morality in terms of a social contract which coordinates alternative systems of internal principles of conduct. Elkind (1981) suggests that adolescent idealism is probably a function of the adolescent's ability to construct a hypothetically ideal world in comparison with which the real world comes up wanting.

Feffer (1970) reports work which finds that adolescents do not simply recognize that different characters in a story have different perspectives on events, they begin to construct elaborated characters whose independent characteristics yield the different perspectives.

This view of early adolescent thinking suggests that, at this age, youth can be expected to be able to generate alternatives to almost any specific action or set of concepts used to deal with any given situation. It also implies that, unless these ideas are tested against reality, they may be seen as having validity equal to that of any other point of view. This has two implications for educational environments. Where the alternatives can be tested for empirical validity, adolescents need to have the opportunity to develop and make the tests, preferably on their own. Secondly, when, as is often the case, the criteria for evaluating the alternatives arise out of different value systems, adolescents need to be exposed to the value implications of the alternatives because they will not see them on their own.

Early adolescents do not have the criteria to judge what constitutes an adequate answer to a problem because they do not yet see it as a whole. Thus they need adults to keep that in front of them. Instructional environments, consequently, need to focus on setting up situations or circumstances where adolescents can either generate and defend their own point of view based on factual evidence or develop and defend alternatives to existing points of view. Frequently, this is fruitfully done through peer interaction in humanities and social science coursework. In the natural sciences, it can be done through a combination of course and laboratory work if the labs are not simply repetition of someone else's work. Labs need to be designed to answer questions which have been raised in the minds of students. Instruction needs to be oriented toward developing these questions and helping students generate answers and test them against the facts.

Data on effective teaching in the junior high grades is hard to find and more difficult to interpret. One possible reason for this is that students are no longer in self-contained classrooms and there is the possibility that what constitutes effective teaching in one discipline is somewhat different than what constitutes effective teaching in another (Evertson, Anderson, & Brophy, 1978). There is also some difficulty in assessing achievement other than specific knowledge of math and science (Evertson & Emmer, 1982). A third difficulty may stem from the developmental heterogeneity of the typical junior high school classroom

Nevertheless, a consistent finding is that student initiated interactions and analytic and inquiry oriented questions continue to increase in impor-

tance. Students of this age make better use of teacher explanations than earlier, and teachers who incorporate student ideas into their teaching are better liked or judged to be more clear (Coker et al., 1976; Evertson et al., 1978; Evertson & Emmer, 1982; Evertson & Veldman, 1981; Flanders, 1965; Fraser & Fisher, 1982; Kennedy, Cruickshank, Bush, & Meyers, 1978). On the other hand, the availability of alternative possibilities without internal criteria for decision making may be expected to make students insecure in their own knowledge. Thus, math teachers who asked questions of volunteers were more effective on achievement measures and students in English classes had strongly negative attitudes if teachers called on nonvolunteers (Evertson et al., 1978).

Management of classroom behavior can also be expected to be a problem with early adolescents. They become unwilling to respond unquestioningly to authority. This is because they can generate their own alternatives and do not yet understand the criteria used for making choices. Thus they test rules, both because they regard rules as arbitrary and because they have an experimental attitude; they want to see what happens when they do something contrary to the rules.

Adolescents need the opportunity to test and question, to be treated as adults but also to be helped to control their own behavior by discussing it beforehand (if possible) or afterward in a way which is nonjudgmental. This is a disorganized period for adolescents, and minor transgressions need to either be ignored or treated lightly in a way which reminds students of expectations and the reasons for them. On the other hand, early adolescents need to have firm expectations and not be let get out of control. Serious problems need to be dealt with immediately, but not in a way that makes the adolescent defensive. Prevention by limiting alternatives may be expected to be effective as may discussion in terms of reasons for expectations and consideration of individual circumstances.

Classroom management techniques which appear to be differentially effective with junior high students include dealing with students' feelings, both positive and negative, teacher confidence, establishing a spirit of cooperation between student and teacher and joking with students (Chiapetta & Collette, 1980; Flanders, 1965; Moskowitz & Hayman, 1976). On the other hand, being one of the group, socializing with students, or being a showman was not correlated with effectiveness, at least in math teachers (Evertson et al., 1978; Flanders, 1965). Effective classroom managers ignore minor misbehavior but intervene rapidly to prevent discipline problems using consistent control techniques (Evertson et al., 1978; Evertson & Emmer, 1982).

Late Formal Operations (Grades 11 and beyond)

In late formal operations thought appears to become totally free of the image in the sense that the interrelations among concepts used become manipulable based on their conceptual interrelationships rather than their relations within the specific image. In the case of the logical operations described by Piaget, the descriptive conceptual systems which apply to the problem at

hand are interrelated logically prior to experimental test rather than concomitant with it. Critical tests which eliminate rival hypotheses for explaining the interrelationships are also conceptualized and systematically carried out (Inhelder & Piaget, 1955/1958).

In the area of social behavior, characteristics appear which seem to be similar to this sort of hypothesis generation and testing. Actions are evaluated as good or bad on the basis of internalized principles of conduct based on universal human rights (Kohlberg, 1969). Individuals enter a "moratorium" status in which they explore different identities, that is, different hypotheses about central values and commitments (Erikson, 1959/1980, 1968; Marcia, 1980; Rowe & Marcia, 1980). They now regard social conventions as a means of regulating social interactions which embody the shared values of the particular group in which they exist (Turiel, 1977). Harvey, Hunt, and Schroder (1961) find that individuals in this stage are exploring themselves in relation to the culture in the process of integrating a coherent self-system which is differentiated from the cultural "personality."

Individuals at this stage may be expected to be beyond the point of questioning for the sake of questioning. They look at new information in relation to what they already know, determine if it fits their existing hypothesis about what is operating in a given situation, and modify their thought or action accordingly. Individuals in this stage search for new knowledge in purposeful and directed ways. The search is based on whether or not they can fit new facts into existing frameworks. These individuals begin to fit knowledge together into disciplines and to think like mature adults. They learn what they want to learn, think for themselves, and can begin to make up their own minds about what they think about a given subject. They may be expected to become selective, deciding for themselves what is important.

These students may be expected to present quite different problems in terms of instructional and behavioral management than students of earlier ages. Because they recognize the need for social conventions appropriate to the specific group, they can be expected to be basically conforming to any rational set of expectations. They may, however, become quite activist about expectations which seem discriminatory or to be an infringement of their rights. The main problem in instructional management will be motivational. These individuals will not be motivated to pursue subjects which are not of interest to them. In large part, what they may be expected to see as of interest depends upon the breadth of prior education. The broader prior training has been, the more interrelated knowledge will become in this period. Instruction which emphasizes this interrelationship will be of more appeal.

Research on effective teacher-student interactions which can be used to test these expectations is almost nonexistent at this level. This is particularly true when achievement is used as the measure of effectiveness. High school students do, however, give high ratings to teachers who respect their opinions (Bowman, 1960 in Samuels & Griffore, 1980; Palonsky, 1977). A significant source of difference in opinion between high school students and teachers in some schools, but not others, is that over the degree to which students should

have a voice in academic decisions (Marsh, 1979; Smith & LaPlante, 1980).

Research on Student-Environment Interaction in Adolescence

As was noted above, there are relatively few studies on effective teaching practices in this age range. One potential reason for this is that there are a variety of developmental levels in any age-graded group above sixth grade. By senior high school, developmental divergence is apparent both within and across programs. In general populations almost 30% of sophomores are formal operational (Shayer, Kuchemann, & Wylam, 1976). A correlation with ability is apparent in the fact that in high ability groups, up to 86% of the students are formal operational (Shayer & Wylam, 1978). The correlation is, however, far from perfect. In one study, seniors in college-prep classes had a few students in early concrete operations (4%), and the most students in formal operations (73%). In contrast, vocational students were 23% early concrete operational and 4% formal operational (Chiapetta & Whitfield, 1977). If, in fact, developmental status is related to the characteristics of effective instruction, then studies of teaching in developmentally heterogeneous groups might show inconsistent effects. Initially, Evertson et al. (1978) were puzzled by the inconsistent pattern of significant results produced by their data from junior high English classrooms. Having found their observational data on teacher effects in math classes to be stable (Evertson, Anderson, Edgar, Minter, & Brophy, 1977; Emmer, Evertson, & Brophy, 1979) they then reanalyzed the English data in terms of the effects of degree of heterogeneity (by student ability) on student engagement (Evertson, Sanford, & Emmer, 1981). Higher heterogeneity in junior high English classes was associated with less student task engagement and cooperation and less successful teacher adaptation of instructional materials.

A group of researchers in the area of personality development has recognized the problem of heterogeneity among junior high and high school students and conducted research in this age range which attempts to look at the interaction between developmental status and environmental characteristics. Although only a few of their studies are classroom observation studies, their results are suggestive enough that they need to be included here.

The research in question arises out of Conceptual Systems Theory (Harvey et al., 1961) which provides a theoretical framework explicitly suggesting that characteristics of the individual interact with characteristics of the environment to produce behavioral outcomes. The theory suggests that individuals develop through a sequence of stages starting from a position of reliance on external standards and definition of right and wrong at the onset of adolescence through a period of self definition to a position of interdependent relations with the environment. In most individuals this development occurs at different rates and, as with formal operations, adult populations show a wide range of developmental levels (Harvey, White, Prather, Alter, & Hoffmeister, 1966).

The theory states that individuals will prefer interpersonal environments which are matched to the interpersonal expectations that accompany a par-

ticular position in the developmental sequence. They will also learn more in such environments.

Students in secondary school range between the early stage and middle stage of conceptual level (CL) development with all levels present in all grades from seven through twelve. In general, there are developmental effects on learning, with students at more advanced developmental stages achieving at higher levels. This is particularly pronounced when achievement is assessed by measures involving more advanced processes on Bloom's taxonomy (Hunt, Joyce, Greenwood, Noy, Reid, & Weil, 1974; McLachlan & Hunt, 1973; Noy & Hunt, 1972; Tomlinson & Hunt, 1971; Zampogna, 1975).

The nature of preferred environment and that which produces higher achievement also varies with developmental status. In general, students at earlier stages of the developmental sequence prefer and/or achieve best in instructional modes where they are told what they are to learn first and then presented with supporting material (Tomlinson & Hunt, 1971) and where independent study is minimized (Tuchman & Orefice, 1973, Zampogna, 1975) as in some lectures (McLachlan & Hunt, 1973). They tend to follow rules established for the inductive process rigidly and to the letter rather than using them as guidelines, as do students at later stages (Hunt et al., 1974).

In contrast, students at middle stages in the developmental sequence tend to achieve better in and to prefer learning environments where there is less direct teaching (McLachlan & Hunt, 1973; Tomlinson & Hunt, 1971, Zampogna, 1975).

A few studies have specifically found matching effects in which students achieve better in environments which are matched to their developmental level and worse where there are mismatches (Hill, 1969; Santmire, 1969).

The results of this research are consistent with those derived from the teacher effectiveness studies, and provide good support for it. Because of the developmental complexity of secondary school groups, this latter type of research appears more fruitful for investigating teaching effectiveness than the more typical process-product design.

Thus, early in this particular developmental sequence individuals should prefer and learn best in highly structured environments in which the instructor is the authority figure who sets standards, directs learning and maintains discipline. At intermediate levels, individuals should prefer and learn best in environments which encourage self expression, self-directed learning and opportunity for comparisons of alternative viewpoints. Authoritarian environments are resisted. At later levels individuals should prefer environments in which they can both contribute and benefit, although they can probably learn well in any environment that provides specific information they feel relevant to their needs. Junior high and high school students can be expected to be in early and early middle stages.

Research to test the validity of these expectations has been conducted both experimentally and naturalistically in junior high, senior high, and some higher educational settings (Miller, 1981). Both achievement and preference for types of instruction have been dependent measures.

The research reviewed in this section provides empirical validation for something we all know intuitively. Students at different ages are different and need to be treated differently in the provision of instructional environments in which they can learn effectively. What is of more importance, however, is that these differences appear to be systematic differences related to the nature of the cognitive and social developmental status of the children. This relationship means that developmental psychology can be used as a theoretical framework for understanding how some effects of teaching occur. This should enable us to more systematically create effective learning environments in schools.

Implications for Teacher Preparation

The synthesis of developmental psychology and teacher effectiveness research which has been attempted here has two sets of implications for teacher preparation. One set of implications is for the content of the program, the other is for the instructional interactions through which teacher preparation is achieved.

In terms of program content, it is apparent that Hunt's (1966b) argument that teachers need to be able to identify relevant student characteristics, decide what environmental characteristics are appropriate, and have the skill to set up an environment which provides them, should be taken seriously. Based on theory and research reviewed above, some specific recommendations can be made.

1. Teacher trainees need to develop a conceptual understanding of the nature of the developmental changes that occur in children generally across the school years and in detail in the grade level range they are preparing to teach.
2. The data suggest that age is not a good indicator of developmental status, although it is better at the elementary school level than at the secondary school level. This means that prospective teachers must be trained to assess developmental status using the student behaviors which are characteristic of the various stages and of various areas of development.
3. Teacher trainees need to be trained to modulate what they expect of and do with children, based on their assessment of their developmental status. The teacher effectiveness literature reviewed above has specific suggestions which can be used as starting points.
4. If the relationship between developmental status, behavioral characteristics, and effective teaching practice can be communicated, teacher trainees may be able to use their knowledge of developmental psychology to determine what to do when specific techniques that they have learned do not apply.

The second set of implications of this body of research is more unusual, but equally important. We cannot ignore the developmental status or our own students in planning our programs!

All of the studies which have assessed developmental status of college students and adults, in either cognitive or personality domains, have found a wide range of developmental levels (e.g., Elkind, 1962b; Hunt & Joyce, 1967; Kuhn et al., 1977; Murphy & Brown, 1970; Rowe & Marcia, 1980). Students range from late concrete operational to equilibrated formal operational and from early to middle levels of personality development.

Again, some specific recommendations can be made based on the research reviewed above.

1. The inclusion of some form of practicum experience is very important. For the more concrete students, it will provide an image base for the concepts we are trying to teach—providing that we use descriptive concepts at first. For the more abstract students, it will provide a testing ground for the development and testing of hypotheses related to effective teaching—providing we help them to develop and test those hypotheses.
2. Our classes need to be organized to meet the developmental needs of our students. More concrete students need low-level concepts presented in clear, unambiguous contexts, without distracting complications, at least until these concepts are well learned. Discussion of issues will be frustrating, although discussion of examples and extensions of conceptual systems should prove interesting and challenging. More abstract students will want opportunities to express their ideas about issues, and may benefit more from inquiry oriented techniques within the context of the cognitive content.

The specific recommendations outlined above are only a few of those that might be developed given the research available. At least as important, however, is the integration of the two bodies of research. This integration allows an understanding of why specific teacher-student interactions work or do not work at different stages of development. This should enable the development and testing of still further techniques. That is, rather than looking only at what has been done that has been effective in the past, we should now be able to suggest new techniques that might be expected to work on a proactive basis.

The integration of these two bodies of knowledge should also be fruitful for developmental psychology. It does not simply confirm some developmental theory, it confirms the usefulness in the "real world" of some of its concepts. It may provide a model for conducting at least some research which integrates basic and applied research, in ways which lead to new understanding.

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